Taylor
Larrechea
10:00-10:50
Phys-131

HW Ch. 11 Ex. 11.7
Supp Ex. 59
Ch. 11 Conceptual Questions: 5, 13
Ch. 11 Prob. 5, 12, 28, 29, 49

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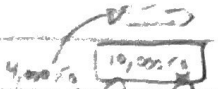
Ch 11 Problems

G=Gravel, C=Cart, A=All

15. 

Inelastic Collision

$m_G v_G + m_C v_C = m_A v_f$

$v_G = 0$ $m_G = 4{,}000$ kg

$v_C = 2.0$ m/s $m_C = 10{,}000$ kg

$m_A = 14{,}000$ kg

$4{,}000\text{ kg}(0\text{ m/s}) + 10{,}000\text{ kg}(2.0\text{ m/s}) = 14{,}000\text{ kg}\, v_f$

$\frac{20{,}000\text{ kg m/s}}{14{,}000\text{ kg}} = v_f$

$v_f = 1.43$ m/s

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Inelastic collision

B=Bird, b=bug, A=All (both)

$v_B = 6.0$ m/s $m_B = 0.31$ kg

$v_b = -30$ m/s $m_b = 0.01$ kg

$m_A = 0.31$ kg

$m_B v_B + m_b v_b = m_A v_f$

$0.3\text{ kg}(6.0\text{ m/s}) + 0.01\text{ kg}(-30\text{ m/s}) = 0.31\text{ kg}(v_f)$

$1.8\text{ kg m/s} - 0.3\text{ kg m/s} = 0.31\text{ kg}\, v_f$

$1.5\text{ kg m/s} = 0.31\text{ kg}\, v_f$

$v_f = 4.84$ m/s

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D=Dan, B=Board, A=All (both)

$m_D = 50$ kg $v_B = 8.0$ m/s

$m_B = 5.0$ kg $v_A = 4.0$ m/s

$m_A = 55$ kg $v_D = ?$

$m_D v_D + m_B v_B = m_A v_f$

$50\text{ kg}\, v_D + 5.0\text{ kg}(8.0\text{ m/s}) = 4.0\text{ m/s}(55\text{ kg})$

$50\text{ kg}\, v_D + 40\text{ kg m/s} = 220\text{ kg m/s}$

$50\text{ kg}\, v_D = 180\text{ kg m/s}$

$v_D = 3.6$ m/s

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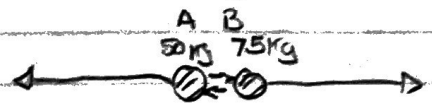
$v_D = 3.6$ m/s

29 

momentum is conserved

$m_B = 75$ kg $m_A = 50$ kg

$v_B = \frac{30\text{m}}{20\text{s}} = 1.5$ m/s $v_A = \frac{30\text{m}}{t}$

$m_B v_B = m_A v_A$

$75\text{kg}(1.5\text{ m/s}) = 50\text{ kg}\left(\frac{30\text{m}}{t}\right)$

$112.5\text{ kg m/s} = 50\text{ kg}\left(\frac{30\text{m}}{t}\right)$

$2.25\text{ m/s} = \frac{30\text{m}}{t}$

$2.25\text{ m/s}(t) = 30\text{m}$

$t = \frac{30\text{m}}{2.25\text{m/s}}$

$t = 13.3$ s

$t = 13.3$ s

49 a.) ⓑ ——▷ [B]

$\mu_K = 0.2$

B = Block

b = bullet

A = Both

$W = \vec{F} \cdot \Delta r \cdot \cos\theta$ $\quad f_{friction} = \mu_K \vec{N}$

$\vec{N} = mg$

$-KE = \mu_K (m_B) \Delta r (\cos 0)$

$-\frac{1}{2} m v^2 = -\mu_K (m_B g) \Delta r$

$\frac{1}{2} m v^2 = \mu_K (m_B g) \Delta r$

$v^2 = 2\mu_K (g) \Delta r$

$v = \sqrt{2\mu_K (g) \Delta r}$

$m_b v_b + m_B v_B = v(m_A)$

$m_b v_b = \sqrt{2\mu_K (g) \Delta r}\,(m_A)$

$$v_b = \frac{\sqrt{2\mu_K (g) \Delta r}\,(m_A)}{m_b}$$

b.) $m_b = 0.01\,kg$, $m_B = 10\,kg$ $\Big\}$ $10.01\,kg$

$\Delta r = 0.05\,m$

$\mu_K = 0.2$

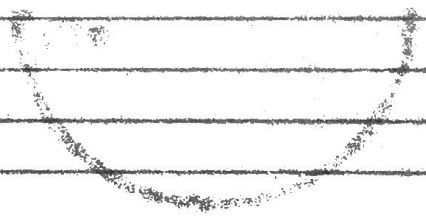
$$v_b = \frac{\sqrt{2(0.2)(9.8\,m/s^2)(0.05\,m)}\,(10.01\,kg)}{0.01\,kg}$$

$v_b = 443.16\,m/s$

Conceptual Questions

6 Carlos is correct because the momentum of the final must equal the initial and since the steel block has two momentums due to one going forwards (steel block) and one going backwards (bullet), the sum of the two momentums (forwards and backwards) must equal the initial momentum; $mv_{i_{initial}} = mv_{Steel} - m_{Bullet}$ where as the wood block scenario is an inelastic collision and has momentum in only one direction and is as follows; $mv_{i_{initial}} = (m_{Both}) v_{Wood\ Block}$. The velocity of the steel block will be faster due to it being summed with the negative bullet velocity to be both equal to zero.

13. (c). both would have to be used. Conservation of energy would be used to find the impact velocity of the two balls. Then after that law of conservation of momentum would be used to find the combined balls' velocity and then conservation of energy to find the max potential height. Then use trigonometry to find θ



67 Inelastic collision

A person sits at rest on a sled on a sheet of ice; their combined mass is 95.0 kg. A 5.0 kg bowling ball is launched horizontally rightwards toward the person with speed 20 m/s. The person catches the ball and the person, sled and ball slide together at the same speed.

a) Determine their velocity after the ball has been caught.

b) Is kinetic energy conserved in this process?

Suppose that the person and sled had been moving left with speed 2.0 m/s prior to catching the ball.

c) Determine their velocity after the ball has been caught.

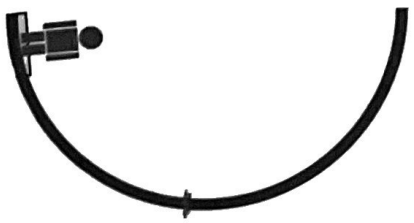
68 Ballistic pendulum

A 0.010 kg bullet is fired horizontally into a 2.0 kg block that is suspended at rest from a string just above the ground. The bullet collides with the block and sticks. The two then swing in a circle and the block reaches a height of 0.30 m above the ground.

a) Determine the speed of the bullet and block just after the bullet has stuck to the block.

b) Determine the speed of the bullet just before the bullet hits the block.

69 Half pipe ①



A 60 kg person rides a 5.0 kg skateboard. Both are at rest at the top of a half-pipe of radius 10 m. Ignore any friction and the rotation of the wheels.

a) Determine the speed of the skateboarder at the bottom of the half pipe.

b) Suppose that there was another skateboarder, of mass 80 kg on a 5.0 kg skateboard at rest at the bottom of the pipe. The two skateboarders collide, hold each other and move together. Determine their speed moments after they collide ④

c) Determine how high up the pipe the two combined skateboarders move.

a.) $K_f + U_f = K_i + U_i$ ($K_f = 0$, $K_i = 0$)

$K_f = U_i$

$\frac{1}{2}mv^2 = mA(g)y$

$\frac{1}{2}v^2 = \frac{mA(g)y}{mA}$

$v^2 = 2gy$

$v = \sqrt{2gy}$

$v = \sqrt{2(9.8 m/s^2)(10 m)}$

$v = 14 m/s$

$v = 14 m/s$

$\Delta E = \Delta K + U$

C.) $\Delta E = \Delta K + \Delta U$

$K_i = U_G$

$\frac{1}{2}mAv^2 = mAgy$

$\frac{1}{2}v^2 = gy$

$v^2 = 2gy$

$36 m^2/s^2 = 19.6 m/s^2 y$

$y = 1.84 m$

b.) $m_1v_1 + m_2v_2 = v(m_1 + m_2)$ ($v_2 = 0$)

$\frac{m_1v_1}{(m_1+m_2)} = v$

$v = \frac{60 kg (14 m/s)}{(60 kg + 80 kg)}$

$v =$

$v = 6 m/s$

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